IN THE CLAIMS:

Please **AMEND** Claims 1, 4-6, 9, 16-17, as follows:

1   1. (Currently Amended)   A subscriber modem apparatus that couples to an

2   analog subscriber line and is operative to cooperate with a cooperative modem located

3   across a digital network, the digital network being coupled to the subscriber line via a

4   network line interface card, the subscriber modem comprising:

5   a remote-echo canceller coupled to receive a downlink training signal sent by the

6   cooperative modem and to process the training signal in order to allow at least one

7   parameter to be adjusted in the remote-echo-canceller, the remote-echo canceller

8   operative to apply the at least one parameter to a downlink signal to produce a digital

9   representation of a remote-echo cancellation signal, wherein the remote-echo cancellation

10   signal is computed such that when it passes through the subscriber line and then combines

11   with an echo signal at the input to an ADC (analog to digital converter) located within the

12   network line interface card, a remote echo-cancellation error signal is produced at the

13   input to the ADC in which at least some components of the echo signal have been

14   substantially reduced, and wherein the a computation of the parameter involves a first set

15   of computations computed at the cooperative modem and a second set of computations

16   computed in the subscriber modem;

17   a modem transmitter module which converts a bit stream into a digital

18   representation of a modulated uplink signal; and

19   a combining unit which combines the digital representation of the modulated

20   uplink signal with the digital representation of the remote-echo cancellation signal and

21   couples the combined signal to a DAC (digital to analog converter) for subsequent

22   coupling as an uplink analog signal onto the subscriber line to be transmitted to the ADC;

23   whereby the ADC thereby samples a signal comprising a superposition of the

24   modulated uplink signal, the echo signal and the remote echo cancellation signal;

25   whereby the superposition of the echo signal and the remote echo cancellation

26   combine to produce a remote echo cancellation error signal, a measure of which is

27   reduced with respect to the echo signal.

Docket Number – Modem050-C1   **- Page 3 -**   priority date: 1/14/99

1   2. (previously presented)   The subscriber modem apparatus according to

2   Claim 1, wherein the at least one parameter is adjusted in response to a command signal

3   sent from the cooperative modem, wherein the cooperative modem evaluates the remote

4   echo error signal and generates the parameter adjustment command to cause the remote

5   echo canceller to generate an improved remote echo cancellation signal that causes the

6   measure of the remote echo cancellation error signal as observed at the ADC to be further

7   reduced.

1   3. (previously presented)   The subscriber modem apparatus of Claim 1,

2   wherein the second set of computations involves generating a remote echo cancellation

3   signal using a first parameter set so that the cooperative modem can evaluate the echo

4   cancellation error signal and indicate how to adjust the at least one parameter.

1   4. (Currently Amended)   The subscriber modem apparatus of Claim 3,

2   wherein a block adaptive filtering algorithm is used to compute the ~~parameter adjustment~~

3   ~~indication~~ first set of computations in the cooperative modem.

1   5. (Currently Amended)   The subscriber modem apparatus of Claim 3,

2   wherein a variant of the filtered-X LMS (FXLMS) algorithm is used to compute the

3   ~~parameter adjustment indication~~ first set of computations in the cooperative modem.

1   6. (Currently Amended)   The subscriber modem apparatus according to

2   Claim 1, further comprising:

3   an uplink training signal generator that causes an uplink training signal to be sent

4   to the cooperative modem via the subscriber line and the digital network;

5   a processing function that causes the downlink training signal to be processed to

6   estimate a set of parameters related to a downlink transfer function; and

7   a processing function that causes the set of parameters related to the downlink

8   transfer function to be sent back to the cooperative modem;

9   wherein the at least one parameter is adjusted in response to a command signal

10   sent from the cooperative modem, wherein the cooperative modem uses at least the

11   uplink training signal and the set of parameters received from the subscriber modem to

12   generate the parameter adjustment command.

Docket Number – Modem050-C1   **- Page 4 -**   priority date: 1/14/99

1   7. (previously presented)   The subscriber modem apparatus of Claim 6,

2   wherein the at least one parameter is further derived from another set of parameters that

3   model a round-trip echo path from the cooperative modem through the line interface card

4   and back to the cooperative modem.

1   8. (previously presented)   The subscriber modem apparatus of Claim 7,

2   wherein the downlink path is modeled as $H_2(z)$, the uplink path is modeled as $H_3(z)$, the

3   round-trip echo path from the cooperative modem through the line interface card and

4   back to the cooperative modem is modeled as $H_1(z)$, and the remote echo canceller is

5   chosen to be a stable and causal approximation to $G(z) = -(\dfrac{H_1(z)}{H_2(z)H_3(z)})$.

1   9. (Currently Amended)   A subscriber modem apparatus that couples to an

2   analog subscriber line and is operative to cooperate with a cooperative modem located

3   across a digital network, the digital network being coupled to the subscriber line via a

4   network line interface card, the subscriber modem comprising:

5   a coupling to receive from the subscriber line a downlink training signal sent from

6   the cooperative modem;

7   a digital signal processor operative to execute software functions in order to

8   process a set of signals;

9   a first software function operative to convert the downlink training signal into a

10   set of downlink channel parameters which serve to parametrically model a downlink

11   transfer function of a communication path extending from the line interface card to the

12   subscriber modem via the subscriber line;

13   a second software function that causes an uplink training signal to be coupled via

14   the subscriber line to the cooperative modem to allow the cooperative modem to model

15   an uplink transfer function;

16   a set of remote echo canceller parameters that are jointly derived using the

17   downlink parameters derived in the subscriber modem and the uplink parameters derived

18   in the cooperative modem;

19   a third software function for use during a normal data-mode operation, which

20   wherein the third software function causes the remote echo canceller to receive a

Docket Number – Modem050-C1   **- Page 5 -**   priority date: 1/14/99

21   downlink data signal, apply it to a digital filter, and generate a remote echo cancellation

22   signal;

23   a combiner function to combine the remote echo cancellation signal with an

24   uplink modem signal;

25   wherein when the combination of the remote echo cancellation signal and the

26   uplink modem signal traverse the uplink subscriber line transfer path and reach an ADC

27   (analog to digital converter) located in the line interface card, whereby at least a

28   substantial component of a downlink-to-uplink echo as seen at the input to the ADC in

29   the line interface card is substantially reduced.

1   10. (previously presented)   The subscriber modem apparatus of Claim 9,

2   wherein the set of remote echo cancellation parameters are further derived from a set of

3   parameters that model a round-trip echo path from the cooperative modem through the

4   line interface card and back to the cooperative modem.

1   11. (previously presented)   The subscriber modem apparatus of Claim 9,

2   wherein the remote echo canceller is implemented as an FIR (finite impulse response)

3   digital filter.

1   12. (previously presented)   The subscriber modem apparatus of Claim 9,

2   wherein the downlink path is modeled as $H_2(z)$, the uplink path is modeled as $H_3(z)$, the

3   round-trip echo path from the cooperative modem through the line interface card and

4   back to the cooperative modem is modeled as $H_1(z)$, and the remote echo canceller is

5   chosen to be a stable and causal approximation to $G(z) = -(\dfrac{H_1(z)}{H_2(z)H_3(z)})$.

1   13. (previously presented)   The subscriber modem apparatus of Claim 12,

2   wherein the approximation to G(z) comprises a finite impulse response filter.

1   14. (previously presented) The subscriber modem apparatus of Claim 12,

2   wherein the approximation G(z) is an infinite impulse response filter.

1   15. (previously presented)   The subscriber modem apparatus of Claim 9,

2   wherein the computation of the set of remote echo canceller parameters involves the

3   solution to a least squares problem.

1   16. (Currently Amended)   The subscriber modem apparatus of Claim 9,
2   wherein the remote echo canceller includes computations that are a member of the group
3   consisting involves the application of at least one of fuzzy logic computations and neural
4   network computations.

1   17. (Currently Amended)   In a communication system involving a digital
2   modem coupled to a digital network, a line interface card that couples the digital network
3   to a subscriber line, and a subscriber modem coupled to the subscriber line, a method of
4   cooperative training used to converge upon a set of parameters for use within a remote
5   echo canceller located in the subscriber modem, wherein the converged set of parameters
6   are iterated to substantially reduce a measure of an echo cancellation error signal as
7   observed at an ADC (analog to digital converter) located within an uplink path of the line
8   interface card, a method comprising:
9   at the digital modem, transmitting a training signal in a downlink direction to the
10   subscriber modem wherein the training signal passes through the line interface card;
11   at the subscriber modem, receiving the training signal from the subscriber line,
12   digitizing the training signal, and applying the digitized training signal to a remote echo
13   canceller, wherein the remote echo canceller uses a present set of parameters in a
14   parametric model to generate a remote echo cancellation signal, and coupling the remote
15   echo cancellation signal via the subscriber line to the line interface card;
16   at the digital modem, receiving a set of values that correspond to a remote-echo-
17   cancellation-error signal as digitized by the ADC within the line card and transmitted
18   back to the digital modem via the digital network, wherein the remote-echo-cancellation-
19   error signal is developed as a superposition of the downlink training signal and the uplink
20   remote echo cancellation signal;
21   at the digital modem, computing a parameter adjustment to produce a modified set
22   of parameters to be used in the remote echo canceller, wherein the parameter adjustment
23   is estimated to reduce a measure of the remote-echo-cancellation-error signal, and
24   transmitting an indication of the parameter adjustment to the subscriber modem;

Docket Number – Modem050-C1   **- Page 7 -**   priority date: 1/14/99

25   in the subscriber modem, adjusting the set of parameters used in the remote echo

26   canceller and readying itself to receive a subsequent training signal for a next iteration of

27   adjustment.

1   18. (previously presented)   The method of Claim 17, wherein a block adaptive

2   filtering algorithm is used to compute the parameter adjustment in the digital modem.

1   19. (previously presented)   The method of Claim 17, wherein a variant of the

2   filtered-X LMS (FXLMS) algorithm is used to compute the parameter adjustment in the

3   digital modem.

1   20. (previously presented)   The method of Claim 17, wherein at least one of a

2   block least squares algorithm, a block Shanno adaptive filtering algorithm, a block

3   conjugate-gradient adaptive filtering algorithm, and a block least mean squares adaptive

4   filtering algorithm is used to compute the parameter adjustment in the digital modem.

1   21. (previously presented)   The method of Claim 17, wherein the method

2   comprises the application of at least one of fuzzy logic computations and neural network

3   computations.